Records of Coho Salmon, *Oncorhynchus kisutch* (Walbaum, 1792), in the Bay of Fundy and its Tributary Drainage

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RECORDS OF COHO SALMON, ONCORHYNCHUS KISUTCH (WALBAUM, 1792), IN THE BAY OF FUNDY AND ITS TRIBUTARY DRAINAGE

by

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ABSTRACT

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Since 1976 there have been 14 confirmed occurrences of coho salmon, involving 1-22 individuals, in the Bay of Fundy and its tributary drainage. Most of these fish were thought to originate from the stocking program for coho initiated in the early 1970's in New Hampshire and Massachusetts, U.S.A. Successful spawning of coho in Bay of Fundy tributaries has occurred on at least three occasions, once in the Digdeguash River, N. B., and twice in the Cornwallis River, N. S. Electrofishing surveys during 1982 failed to capture any coho parr in 28 New Brunswick coastal Bay of Fundy streams. Nine coho parr were captured in the Cornwallis River in the fall of 1982 and five more the following spring.

Key words: Pacific salmon, Oncorhynchus kisutch, exotic introductions, migration, natural reproduction, competition, Atlantic Salmon, New Brunswick, Nova Scotia

RÉSUMÉ

Martin, J. D., and M. J. Dadswell. 1983. Records of coho salmon, Oncorhynchus kisutch (Walbaum, 1792), in the Bay of Fundy and its tributary drainage. Can. Tech. Rep. Fish. Aquat. Sci. 1204: iii + 6 p.

Dupuis 1976, on a signalé 14 occurrences confirmées de saumons coho, impliquant de 1 à 22 sujets, dans la baie de Fundy et son bassin hydrographique. On croit que la plupart de ces poissons proviennent due programme de peuplement de saumons coho mis sur pied au début des années 1970 dans le New Hampshire et le Massachusetts, aux É.-U. Cette espèce a frayé avec succès dans les tributaires de la baie de Fundy au moins en trois occasions, une fois dans la rivière Digdequash (N.-B.) et deux fois dans la rivière Cornwallis (N.-É.). Des relevés par électro-pêche effectués en 1982 n'ont rapporté aucun tacon de saumon coho dans 28 cours d'eau se déversant dans la baie de Fundy, du côté du Nouveau-Brunswick. Neuf tacons ont été capturés dans la rivière Cornwallis à l'automne 1982, et cinq autres le printemps suivant.

INTRODUCTION

The introduction of coho salmon, Oncorhynchus kisutch (Walbam, 1792), along the Atlantic coast of North America has created concern among several sport fishing organizations and conservation groups, as well as in government fisheries departments. Coho salmon are native to the Pacific Ocean and its tributary drainage in both North America and Asia. They are anadromous, returning to freshwater streams to spawn. Spawning occurs from October to January in swift, shallow water over gravel (Scott and Crossman 1973). Alevins emerge from the gravel in spring and most remain in fresh water for 1 yr before smoltification and migration to the ocean or a large lake. Most coho spend two summer seasons in the ocean, returning to spawn in the fall of the second year. Spawning runs may also include jacks, usually precocious males, returning after one summer season following smoltification.

The predicted effects of introduced non-indigenous salmonids on native Atlantic salmon are: destruction of Atlantic salmon redds by a later spawning species, interspecific competition among parr, predation of Atlantic salmon parr and fry by the faster growing Pacific salmon parr, and the possible introduction of diseases or detrimental parasites (Solomon 1979; Gibson 1981).

Introductions for aquaculture operations of non-indigenous fish in the Maritimes are controlled by the Advisory Committee on Introduction of Non-indigenous Species. Coho salmon have not been introduced in Atlantic Canada (G. Turner, pers. comm.).

This report summarizes records of cohos from the Bay of Fundy and some of its freshwater tributaries. Also presented are the results of an electrofishing survey during 1982 to learn whether or not spawning populations of coho are established in The Bay of Fundy drainage of New Brunswick.

METHODS

Records of reported coho salmon catches were maintained by the Identification Center at the Biological Station in St. Andrews. Confirmation of coho specimens obtained was by Dr. W. B. Scott of The Huntsman Marine Laboratory, St. Andrews, N. B.

A total of 28 New Brunswick coastal Bay of Fundy streams extending from the St. Croix River at St. Stephen to the Shepody River at Moncton were sampled during the summer of 1982 (Fig. 1). Sampling was conducted by electrofishing with Smith-Root back-pack electroshockers (Mark IV and Mark VII) at 400-500 volts, using uninterrupted direct current. Two sampling methods were used: the electrofishing crews after selecting an accessible site, proceeded upstream fishing potential salmonid habitat for 20 min at each site. This was a spot check. If juvenile Atlantic salmon (Salmo salar) were captured, then a riffle-type region of the stream of approximately 100 m^2 was selected, blocked with fine mesh nets to prevent fish from entering and leaving, and a census made. The area was electroshocked by working back and forth across the stream while proceeding upstream. Three sweeps were made at each site. Stunned fish were collectd with dip nets, sorted to species and counted. Atlantic salmon parr were anaesthetized

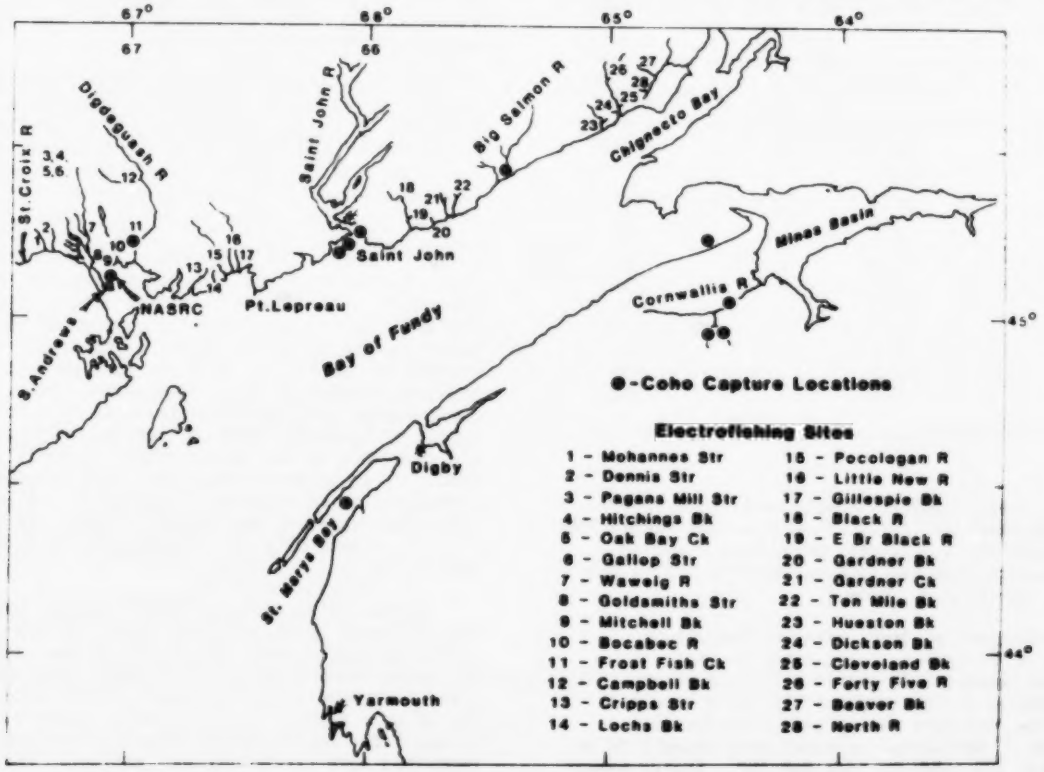

Fig. 1. Locations of coho captures and New Brunswick electrofishing sites.

with tertiary amyl alcohol and measured to the nearest millimeter and released. Population estimates of parr and fry/100 m^2 were calculated by using the DeLury method (Zippin 1956).

COHO INTRODUCTION

Scott and Crossman (1973) provide records of coho salmon introductions in eastern North America. Earliest introductions in Ontario, Ohio and Michigan occurred between 1873 and 1878 in Lake Erie. They were unsuccessful. Some Ohio streams tributary to Lake Erie were stocked again in 1933, but with no success. Stocking of the Great Lakes, which was begun by Michigan in 1966, Ohio and New York in 1968 and Ontario in 1969, was successful and resulted in a large coho sport fishery (Scott and Crossman 1973; Pearce 1980). Reproducing populations of coho are now established in many streams of the Great Lakes' drainage system. Coho have also spread down the St. Lawrence as far as Montreal (Gruenfeld 1977).

During the early 1900's, unsuccessful attempts were made to introduce coho into rivers from Maine to Maryland. In 1968, however, New Hampshire began a yearly coho release program in Great Bay, near Portsmouth. Massachusetts followed in 1969 with releases in the North River. Largest releases of coho smolts by these states were in 1982, 300,000 by New Hampshire and 70,000 by Massachusetts. Releases to date are in excess of 2 million for New Hampshire and ½ million for Massachusetts (Table 1, C. J.

Table 1. Coho stocking in New England (in thousands of fish).

Year	Massachusetts	New Hampshire
1971	61.0	
1972	64.5	
1973	66.0	272
1974	73.5	152
1975	18.0	130
1976	48.0	115
1977	4.5	134
1978	30.0	192
1979	46.5	249
1980	11.0	280
1981	67.0	237
1982	70.0	300

Stearns, pers. comm.). Yearly adult coho returns to New Hampshire for 1977-80 inclusive have ranged from 0.33-0.80% (R. S. Fawcett, pers. comm.) and to Massachusetts for the same period from 0.11-1.45% (K. E. Reback, pers. comm.).

Additionally, three private aquaculture companies in Maine cultured cohos in cages in seawater between 1971 and 1976 (Jaegoe et al. 1981). The ventures failed commercially "as a result of cash flow, hatchery supply and biotechnical problems." Accidental releases were thought to be less than 100 cohos/yr (Sea Run Inc., Evelyn Sawyer, pers. comm.).

REPORTS OF INCIDENTAL CATCHES

Confirmed catches of coho salmon in the Bay of Fundy and its tributaries began in 1976 (Table 2). Numbers and sizes of captured cohos have ranged from one individual to two dozen and from 75-mm parr to 645-mm adults. Most have been captured by commercial fishermen or during electro- shocking surveys of streams (Table 3).

Although confirmed records of coho from the Bay of Fundy are few, they probably represent only a small percentage of the total number present. Unconfirmed reports range from the occasional individual to catches of several hundred. A report of about 400 coho captured in a herring weir was considered quite reliable when a specimen from another catch of 22 similar fish in the same weir, referred to as a "salmon-trout" and brought in by a commercial fishermen for identification, proved to be a coho jack. During the fall of 1981, from about mid-September until the end of October, small salmon about 230-330 mm long, thought to be coho, were regularly sighted jumping and in herring weir catches along the New Brunswick coast from Saint John to Passamaquoddy Bay (D. Thompson, pers. comm.). The fishermen considered this "unusual". However, because of restrictions on catching Atlantic salmon the fishermen remained silent about the occurrence until the herring season was over.

It is noteworthy that most confirmed reports of coho were made by biologists during occasional sampling trips for other fishes. It is reasonable to assume commercial fishermen with large quantities of gear operational during the entire fishing season would capture far more cohos. Many of the confirmed records in this report were obtained by investigating rumors of coho catches, some from government fisheries personnel.

In spite of the number of reports of coho present in the Bay of Fundy, only three known incidents of successful spawning have been observed. An estimated population of 24 underyearling coho was found in Frost Fish Creek, a tributary of the Digdeguash River in southwestern New Brunswick in the fall of 1976 (Symons and Martin 1978). Yearly electrofishing of Frost Fish Creek since 1976 has failed to reveal any more coho. The discovery of a dead adult coho in the Cornwallis River in Nova Scotia (Fig. 1) "around Christmas in 1978" (E. Robinson, pers. comm.) and the capture of three juvenile coho in Sharpe Brook, tributary to the Cornwallis, in October 1979 (D. Cox, pers. comm.) indicate successful spawning occurred there. A further nine coho parr were found in the Cornwallis system in September 1982 (B. Sabean, pers. comm.) and five more by the senior author in April and May 1983. It is possible these parr were progeny of the 1979 parr, which returned as adults in the fall of 1981 after spending two summers at sea. If this is correct, a naturally reproducing population may be developing.

Sabean noted that 37 Atlantic salmon parr and fry, 71 brown trout, 27 brook trout, as well as eels and sticklebacks were also caught at the 1982 site on Condon Brook along with the cohos (Fig. 1). No other coho were caught upstream of this site nor at any of nine 9 other electrofishing stations on the Cornwallis. The electrofishing site on Condon Brook contained both riffle and pool habitat. The coho were found in the pools (B. Sabean, pers. comm.).

Table 2. Records of coho salmon in New Brunswick and Nova Scotia.

Location	Date	No.	Size (mm)	Sex	Gear
[a]Frost Fish Ck., N.B.	Oct.-Nov. 1976	20	75-100	-	Electroshocker
[a]St. Mary's Bay, N.S.	June 6, 1978	1	post-smolt	-	Weir
[a]Morden, N.S.	June 17, 1978	1	300	F	Weir
Cornwallis R., N.S.	Dec., 1978	1	610	-	Dead on shore
[b]Sharpe Bk., N.S.	Oct. 17, 1979	3	parr	-	Electroshocker
Big Salmon R., N.B.	Sept. 3, 1980	1	437	M	Seine
Chamcook Hbr, N.B.	July 30, 1981	1	645	M	Weir
Saint John Hbr., N.B.	Sept. 15, 1981	1	342	-	Gillnet
Sheldon Pt., N.B.	Oct., 1981	22	jack	-	Weir
Lorneville, N.B.	Nov. 3, 1981	2	332	M	Gillnet
Condon Bk., N.S.	Sept. 7, 1982	9	85-109	-	Electroshocker
Lorneville, N.B.	Oct., 1982	2	230-250	-	Gillnet
Sharpe Bk., N.S.	Apr. 28, 1983	2	parr	-	Electroshocker
Tupper Lake Bk., N.S.	May 10, 1983	3	smolt 92-112	-	Electroshocker

[a]Tagged in New Hampshire April 18, 1978.
[b]Eroded fins, possible left ventral fin clipped.

Table 3. Results of 1982 New Brunswick coastal Bay of Fundy stream survey.

Stream No.[a]	Location	Date	Temp °C	Atl. salmon Parr	Atl. salmon Fry	Trout	eels	Black nose dace	Sucker	Creek chub	Burbot	Sculpin	Pearl dace	Other
1	Mohannes Str.	12/08					2				1			
2	Dennis Str.	18/08	23.0	1	10		9							
3	Pagans Mill Str.	12/08					30							2[b]
4	Hitchings Bk.	12/08				6								70[b]
5	Oak Bay Ck.	07/07	18			45	5							
6	Gallop Str.	12/08		1		4	6							
7	Waweig R. Sta. 1	17/08	19.0	41	14		7	9						
	Sta. 2	17/08		17	5		18	2	2	1				
8	Goldsmiths Str.	12/08	19.0				10	15		2				
9	Mitchell Bk.	19/07				22	50							
10	Bocabec R.	19/07	22.5	22	1		30	17	1				1	
11	Frost Fish Ck.	06/07		30	26	97	15							
12	Campbell Bk.	20/08	22.0	17	13	2	1	9						
13	Cripps Str. (mouth)	20/07	9.5			27								
	(3 km upstream)	20/07				36								
14	Lochs Bk.	20/07					20							
15	Pocologan R.	01/09		35	23	1	1							
16	Little New R.	27/09	15.1	25		1		4						
17	Gillespie Bk.	20/07	14.5			11	20							
18	Black R.	23/08	17.0	50	53		4	5						1[b]
19	E. Br. Black R.	23/08	21.0			7	1							
20	Gardner Bk.	23/08	13.0			7	4							
21	Gardner Ck.	23/08	18.0	14	20	3	8							
22	Ten Mile Bk.	24/08	18.0	19	1	35	1							
23	Hueston Bk.	25/08				10								
24	Dickson Bk.	25/08	13.5	7	4	25								
25	Cleveland Bk.	25/08	13.0	8		13						45		
26	Forty Five R.	25/08												
27	Beaver Bk.	25/08			6	5	1							
28	North R.	25/08				3						12		

[a]See Fig.1 for location.
[b]Hatchery reared rainbow trout and a melanistic Atlantic salmon parr.

THE 1982 NEW BRUNSWICK SURVEY

No coho salmon were captured during the electrofishing survey in New Brunswick during 1982. Atlantic salmon, brook trout (Salvelinus fontinalis), American eel (Anguilla rostrata) and blacknose dace (Rhinichthys atratulus) were the most common species caught (Table 3). Other species included slimy sculpin (Cottus cognatus), white sucker (Catostomus commersoni), creek chub (Semotilus atromaculatus), rainbow trout (Salmo gairdneri) and burbot Lota lota). Population estimates for Atlantic salmon ranged from 12.4 to 51.7 parr/100 m^2 and 15.4 to 49.9 fry/100 m^2 (Table 4). Many small streams and rivers had larger Atlantic salmon parr populations than suspected, indicating some may have substantial adult salmon runs.

Table 4. Estimated numbers of Atlantic salmon parr and fry/100 m^2.

Location	Area (m^2)	Date 1982	Est. no. parr/100 m^2	Est. no. fry/100 m^2
Bocabec R.	155	19/07	20.1	0
Waweig R.	91	17/08	51.7	15.4
Campbell Bk.	114	20/08	22.8	12.3
Black R.	112	23/08	45.5	49.9
Gardner Ck.	107	23/08	13.1	18.8
Ten Mile Bk.	54	24/08	37.0	0
Cleveland Bk.	64	25/08	12.4	0
Pocologan R.	90	01/09	38.8	32.2
Little New R.	117	27/09	16.2	0

DISCUSSION

Information gathered to date indicates coho salmon are present in the Bay of Fundy and its tributaries. Origin of these fish is probably from releases of coho smolts by New Hampshire and Massachusetts. Tag returns of New Hampshire released coho were obtained from weir fishermen at St. Mary's Bay and Morden, N. S., during the summer of 1978 (New Hampshire Fish and Game, R. Fawcett, pers. comm.). An adult coho captured in Big Salmon River N. B., in 1980 (Fig. 2) had eroded fins, indicating hatchery origin, and a possible left ventral fin clip, one of the marks used for New Hampshire releases (R. Fawcett pers. comm.).

Coho occurrence in the Bay of Fundy may be attributed to a feeding migration around the Bay as demonstrated by other fish species (Dadswell et al. 1983). Spawning populations are not yet well established. The Cornwallis River system seems a likely possibility as the site of the first self-sustaining population.

Yearly sampling of streams by electrofishing, particularly in pool habitat (Peterson 1982), should continue in order to document any increase in coho parr abundance. Continued compilation of reports of coho, especially from herring weir fishermen, appears the best method for monitoring the presence and numbers of coho jacks and salmon in the Bay of Fundy. A request for information along with a description of these fish, disbributed amoung sport and commercial fishermen, could improve the number and validity of reports. Avenues for distribution could be angling summaries or, in the case of commercial fishermen, through community service officers. A cooperative effort would be required for positive identification of specimens and for maintaining record files.

All information gathered would help to provide a data base in the event coho salmon became clearly established in the Bay of Fundy drainage system and threatened continued production of Atlantic salmon. At such time a policy decision may be required, if it was considered best to eradicate any successfully established coho populations. On the other hand, such research might indicate the coho were not competing with Atlantic salmon and by exploiting an unoccupied "niche" could enhance the salmon production of Maritime streams.

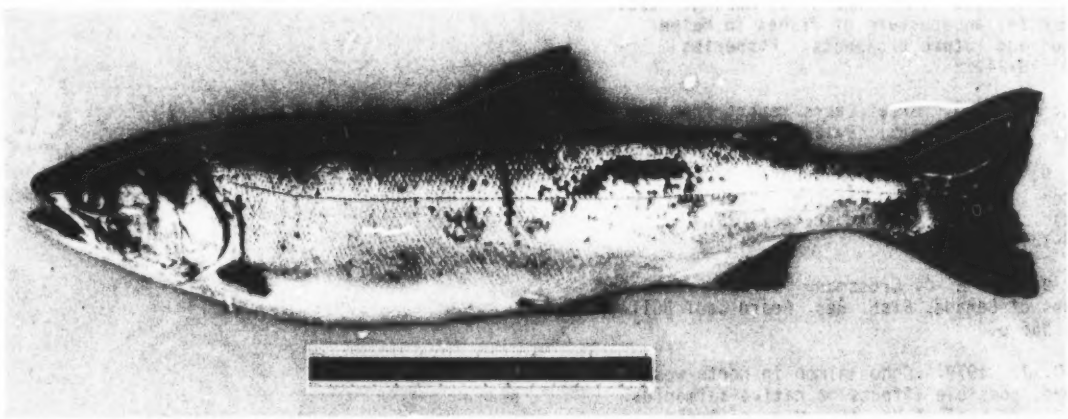

Fig. 2. Coho captured in Big Salmon River, N. B., Sept. 3, 1980, showing eroded but healed fins and possible left ventral fin clip.

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